Claims

What is claimed is:

1. A method for detecting the mark in an image comprising:
   a. obtaining an image of at least one mark;
   b. locating the center of each mark based on symmetry
   c. processing the mark image using at least one directional elongated filter;
   d. rejecting artifacts based on symmetry

2. The method of claim 1 further comprising a step of classifying mark type.

3. The method of claim 2 wherein features for mark classification are derived through a sequential process.

4. The method of claim 1 wherein at least one parameter of the directional elongated filter is determined by learning.

5. The method of claim 1 wherein features of the mark are extracted using directional elongated filters

6. The method of claim 2 wherein features for classification of mark type are selected from a group consisting of curvature of an arc, intersection angle of lines, relative position of lines, relative angle between lines, direction of symmetry axes, parallelism, projection of detected marks to the symmetry axes, and orthogonality of lines.

7. A method of locating a detected mark's position in an image comprising:
   a. creating a gray scale image of at least one mark;
   b. masking portions of the image based upon detected mark elements;

c. estimating mark position using a structure guided estimation process.

8. The method of claim 7 wherein detected mark elements determine the constraints applied to the structure guided estimation process.

9. The method of claim 7 further comprises inner and outer marks wherein inner and outer marks position are sequentially determined.

10. The method of claim 7 wherein portions of a mark are excluded from the estimation of mark position based upon detection results.

11. The method of claim 7 further comprises a weight image to emphasize particularly important or definitive portions of the mark.

12. The method of claim 11 wherein the weight image is learned.

13. The method of claim 8 wherein the constraints are selected from a group consisting of parallel lines, perpendicular lines, rings, circles, arcs, line length, intersection angle of lines, and line width.

14. A method of measuring orientation of a mark in an image comprising:
    a. obtaining an image of at least one mark;
    b. locating the center of the each mark along each axis of symmetry;
    c. measuring the mark orientation using a structure-guided estimation process.

15. The method of claim 14 wherein detected mark determines the constraints applied to the structure guided estimation process.

16. The method of claim 14 further comprises inner and outer marks wherein inner and outer marks orientation are sequentially determined.

17. The method of claim 14 wherein portions of a mark are excluded from the estimation of mark orientation based upon detection results.

18. The method of claim 14 further comprises a weight image to emphasize particularly important or definitive portions of the mark in the structure guided estimation process.

19. The method of claim 15 wherein the constraints are selected from a group consisting of parallel lines, perpendicular lines, rings, circles, arcs, line length, intersection angle of lines, and line width.

20. The method of claim 18 wherein the weight image is learned.

21. A method of learning specific mark structure comprising;
    a. obtaining an image of at least one mark;
    b. filtering the image using at least one directional elongated filter;
    c. determining at least one parameter of the mark through a learning process.